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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,271	07/08/2003	Yung-Feng Cheng	10109-US-PA	1270

31561 7590 11/01/2005

JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
TAIPEI, 100
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EXAMINER

RUGGLES, JOHN S

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 11/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/604,271

Applicant(s)

CHENG ET AL.

Examiner

John Ruggles

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) none is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Response to Amendment

Claims 1-10 have all been amended in the submission filed on 7/14/05.

Specification

The previous objection to the title has been overcome by amendment.

Specifically exemplified previous objections to the specification have been overcome by Applicants' amendments. However, further examples of objections to remaining unamended portions of the specification are again listed below.

35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms, which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: (4) in paragraph [0004] line 29 (which is the first line on page 3), "a opaque panel" should be corrected to --an opaque panel--; (5) in [0004] line 64 (in the third line from the end of this paragraph on page 4), "defects due overlay problems" should be changed to --defects due to overlay problems--; and (6) in [0004] line 67 (which is the last line of this paragraph on page 4), "number photomasks" should be corrected to --number of photomasks--. Note that due to the number of errors, those listed here are merely examples of the corrections needed and do not represent an exhaustive list thereof.

Art Unit: 1756

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

The previous objection to the abstract of the disclosure has now been overcome by amendment.

Claim Objections

The previous objection to claims 2-6 and 10 have been overcome by amendments. However, current amendments of the claims have necessitated a new objection to claim 4 as set forth below.

Claim 4 is objected to because of the following informalities: claim 3, on which claim 4 depends, has now been amended to recite "A light projection system", instead of a photomask. Therefore, in claim 4, "The photomask of claim 3" should be changed to --The ~~photomask~~ light exposure system of claim 3--, in order to be more clear and consistent with current amendments to the claims (note that both of claims 5 and 6, which also depend on claim 3, have already been similarly amended). Appropriate correction is required.

Claim Rejections - 35 USC § 112

The previous rejection under the first paragraph of 35 U.S.C. 112 and a portion of the previous rejection under the second paragraph of 35 U.S.C. 112 have been overcome by current

Art Unit: 1756

amendments to the claims. However, these amendments have also necessitated new and rewritten rejections under the second paragraph of 35 U.S.C. 112, as set forth below.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claims 1-2, 5, and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1 lines 8-9, it is unclear how the intended use recitation “wherein the second direction is perpendicular to a common line of two light exit apertures used for exposing the photomask” further limits the actual structure of the photomask being claimed. Accordingly, for the purpose of this Office action and in order to expedite prosecution of this application, the above recitation in claim 1 has not been considered as further limiting the actual structure of the claimed photomask. Claim 2 depends on claim 1.

In claim 5 lines 2-4, the recitation of “when the parallel lines of the second pattern are positioned along a **vertical direction that is perpendicular with respect to the common line** of two light exit apertures” (emphasis added) is inconsistent with the disclosed invention as exemplified by the description in [0022] of instant Figure 4. For the purpose of this Office action and in order to expedite prosecution of this application, the above recitation in claim 5 has been interpreted to mean --when the parallel lines of the second pattern are positioned along a **~~vertical~~ horizontal direction that is perpendicular with respect to the common line** of two light exit apertures--.

Similarly in claim 9 lines 2-4, the phrase “when the parallel lines of the **horizontal** pattern are positioned along a **vertical** direction that is perpendicular with respect to the common line of two light exit apertures” (emphasis added) is internally inconsistent (the same set of parallel lines cannot be positioned along both horizontal and vertical directions at the same time). However, for the purpose of this Office action and in order to expedite prosecution of this application, the above phrase in claim 9 has been interpreted to mean --when the parallel lines of the **horizontal** pattern are positioned along a ~~vertical~~ horizontal direction that is perpendicular with respect to the common line of two light exit apertures--, in accordance with the disclosed invention as exemplified by the description in [0022] of instant Figure 4.

Claim Rejections - 35 USC § 102

Changes to the following rejection have been necessitated by claim amendments.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2 are rejected under 35 U.S.C. 102(e) as being anticipated by Pierrat (US Patent Application Publication 2002/0127479).

The mask of claim 1 has been interpreted as stated above in the rejection under the second paragraph of 35 U.S.C. 112, as being limited only by the actual structural limitations recited and not being further limited by the recited intended use.

Art Unit: 1756

Pierrat teaches techniques for extending masks to form complex layout patterns (abstract) that include several variations of both first and second sets of parallel lines along different directions on the same mask (e.g., see Figures 12, 15, 16, 17, and 18, etc., as described in e.g., paragraphs [0109], [0112-0118], etc.) by including sub-resolution features or internal assistant patterns for optical proximity correction (OPC), as shown in Figure 21 (paragraphs [0179-0180]). In the mask of Figure 21, opaque field 250 surrounds closely spaced parallel lines of a first region 251 and a second region 252. Rectangular shaped sub-resolution or internal assistant patterns 253 and 254 are formed within region 251 and rectangular shaped sub-resolution or internal assistant patterns 255 and 256 are formed within region 252. These shaped sub-resolution internal assistant patterns (253-256) on the mask allow the closely spaced parallel lines imaged by mask regions 251 and 252 to be much straighter and much more uniform in the resulting exposure patterns ([0180] lines 7-9), as shown in Figure 22.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over any one of Terashi (US Patent 6,934,009), Fritze *et al.* (US Patent 6,884,551), or Fritze *et al.* (US Patent 6,934,007) in view of Pierrat (US Patent Application Publication 2002/0127479).

Art Unit: 1756

The mask of claim 1 has been interpreted as stated above in the rejection under the second paragraph of 35 U.S.C. 112, as being limited only by the actual structural limitations recited and not being further limited by the recited intended use.

Terashi teaches an illumination exposure apparatus or light projection system including a means for illuminating different portions of a mask or reticle with different illumination conditions (title, abstract). Such a mask 10A is alternatively shown in Figure 6 to include a first area 18 having a first pattern of parallel lines 17 oriented along a first direction (shown to be horizontal) and a second area 16 having a second pattern of parallel lines 15 oriented along a second direction (shown to be vertical), which is clearly different from the first direction (col. 9 lines 62-65).

Fritze *et al.* '551 teach an alternative mask having a first pattern of parallel lines formed in a first vertical orientation or direction 23B in a first region and a second pattern of parallel lines in a second horizontal orientation or direction 23A that is clearly different from (e.g., perpendicular to, etc.) the first orientation or direction of the first pattern of parallel lines, in which both sets of parallel lines are on the same mask, as shown in Figure 12 (col. 10 lines 44-47).

Similarly, Fritze *et al.* '007 teach an alternative mask having a first pattern of parallel lines formed in a first vertical orientation or direction 23B in a first region and a second pattern of parallel lines in a second horizontal orientation or direction 23A that is clearly different from (e.g., perpendicular to, etc.) the first orientation or direction of the first pattern of parallel lines, in which both sets of parallel lines are on the same mask, as shown in Figure 15 (col. 10 lines 11-14).

Art Unit: 1756

While teaching plural sets of parallel lines oriented in different directions on the same mask, neither Terashi, Fritze *et al.* '551, nor Fritze *et al.* '007 specifically teach the additional use of an internal assistant pattern comprising a shaped structure formed in the first pattern of parallel lines (instant claim 1) wherein the shaped structure is a square, a rectangle, or a circle (instant claim 2).

However, as previously discussed above, the use of rectangular shaped sub-resolution internal assistant patterns in closely spaced parallel lines on a mask are shown by Pierrat's Figure 21 (paragraphs [0179-0180]). The inclusion of these sub-resolution internal assistant patterns allow the closely spaced parallel lines imaged by the mask to be much straighter and much more uniform in the resulting exposure patterns ([0180] lines 7-9), as shown in Pierrat's Figure 22.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the mask taught by either Terashi, Fritze *et al.* '551, or Fritze *et al.* '007 having plural sets of parallel lines oriented in different directions on the same mask to include a sub-resolution internal assistant pattern comprising a shaped structure (e.g., where the shaped structure is a rectangle, etc., instant claim 2) in at least the first set of closely spaced parallel lines on the mask, in order to allow the closely spaced parallel lines imaged by the mask to be much straighter and much more uniform in the resulting exposure patterns, as taught by Pierrat (instant claim 1).

Claims 3-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pierrat (US Patent Application Publication 2002/0127479) in view of either Poschenrieder *et al.* (US Patent 5,815,247) or Tu *et al.* (US Patent 6,150,058).

Art Unit: 1756

As described above, Pierrat does not specifically teach: *[1]* a light projection system comprising an opaque panel having two light exit apertures positioned along a common line (for the beneficial use of dipole off-axis illumination during exposure of the mask) and *[2]* a mask having plural separate sets of parallel lines oriented in different (e.g., perpendicular, etc.) directions so that these plural separate sets of parallel lines are transferred in a single exposure step.

Poschenrieder *et al.* teach the beneficial use of an off-axis illumination or light projection system (Figure 1, e.g., for dipole off-axis illumination, etc.) involving the use of an aperture plate 12 that is alternatively shown in Figure 3A as an opaque panel having two openings or light exit apertures positioned along a common line *[1]* to illuminate a mask pattern 16 for the purpose of overcoming direction dependent differences in exposure behavior for various mask patterns (which is understood to include multi-directional mask patterns, abstract, column 3 lines 19-30, 47-49, and 51-53). The orientation of line patterns on the mask 16 and that of the common line between the two apertures of the dipole aperture plate 12 are directionally dependent. This is understood to mean that plural different directions or orientations of lines on the mask can be accommodated by an appropriate (e.g., 90°, etc.) twist or rotation of the dipole aperture plate between plural exposures at appropriate doses tailored to the desired proportions for providing the best overall image (column 3 lines 53-59). Figure 1 suggests that the common line of the dipole aperture plate 12 should be positioned perpendicular to the direction of parallel lines on the mask for each exposure to maximize the off-axis effect of dipole illumination *[2]*.

Tu *et al.* also teach an optical or light projection system (Figure 5) for the beneficial use of dipole off-axis illumination by an alternative dipole aperture plate 22 having two light

Art Unit: 1756

openings or apertures 28 equally spaced from the optical axis 26 of the dipole aperture plate such that the apertures 28 are co-linear (along a common line) with the optical axis 26, as shown in Figure 6B. This dipole off-axis illumination provides improved resolution and depth of field for mask patterns having a number of closely spaced parallel lines (column 4 line 53-63) and is also expected to reduce side lobe in a resulting image for closely spaced parallel lines running predominantly in one direction on a mask (column 2 lines 4-13, [1]). This dipole off-axis illumination suggests that the common line of the dipole aperture plate 22 would be positioned perpendicular to the direction of parallel lines on the mask for exposure to maximize the off-axis effect of dipole illumination. For parallel lines running in plural directions (e.g., that are perpendicular to each other, etc.) on the mask [2], quadrupole off-axis illumination can be used (column 2 lines 13-15).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the use of internal assistant patterns in a first set of closely spaced parallel lines on the mask as taught by Pierrat with the use of a dipole off-axis illumination system taught by either Poschenrieder *et al.* or Tu *et al.* for a second set of closely spaced parallel lines without internal assistant patterns on the same mask, in which the second set of parallel lines has a different orientation or direction than that of the first set of parallel lines, [1], [2]. This is because it is beneficial to use dipole off-axis illumination in a light projection system for providing the best overall image by maximizing the off-axis effect when the common line of the dipole aperture plate is positioned perpendicular to the direction of a (second) set of parallel lines (without having internal assistant patterns) on the mask, as taught by Poschenrieder *et al.*, while using the internal assistant patterns taught by Pierrat in another (first) set of closely spaced

Art Unit: 1756

parallel lines not benefiting from the maximized off-axis effect of the dipole illumination (due to their different orientation that is not perpendicular to the common line of the dipole aperture plate), in order to allow both the (second) set of closely spaced parallel lines (benefiting from the maximized off-axis illumination) and the (first) set of closely spaced parallel lines (not benefiting from maximized off-axis illumination) on the same mask to be imaged during a single exposure so that images from both sets of closely spaced parallel lines are straight and uniform in the resulting single exposure patterns. It is also expected to be beneficial to use dipole off-axis illumination in a light projection system for providing improved resolution and depth of field while reducing side lobe in a resulting image for mask patterns when the common line of the dipole aperture plate is positioned perpendicular to the direction of a (second) set of closely spaced parallel lines (without having internal assistant patterns) running predominantly in a single direction on the mask to maximize the off-axis effect of dipole illumination, as taught by Tu *et al.*, while using the internal assistant patterns taught by Pierrat in another (first) set of closely spaced parallel lines not benefiting from the maximized off-axis effect of the dipole illumination (due to their different orientation that is not perpendicular to the common line of the dipole aperture plate), in order to allow both the (second) set of closely spaced parallel lines (benefiting from the maximized off-axis illumination) and the (first) set of closely spaced parallel lines (not benefiting from maximized off-axis illumination) on the same mask to be imaged during a single exposure so that images from both sets of closely spaced parallel lines are straight and uniform in the resulting single exposure patterns. All three cited references (Pierrat, Poschenrieder *et al.*, and Tu *et al.*) relate to the same art of optical proximity correction for

Art Unit: 1756

closely spaced patterns, such as sets of parallel lines, on a mask used in photolithography (instant claims 3-10).

Response to Arguments

The previous objections to the title and abstract have both been overcome by current amendments thereto.

Specifically exemplified previous objections to the specification have been overcome by Applicants' amendments, but further examples of objections to remaining unamended portions of the specification are again listed above.

The previous objection to claims 2-6 and 10 have been overcome by amendments thereto, but current amendments of the claims have necessitated a new objection to claim 4 as set forth above.

The previous rejection under the first paragraph of 35 U.S.C. 112 and a portion of the previous rejection under the second paragraph of 35 U.S.C. 112 have been overcome by current amendments to the claims, but these amendments have also necessitated new and rewritten rejections under the second paragraph of 35 U.S.C. 112, as set forth above.

Applicants' arguments with respect to claims 1-10 have been considered, but are moot in view of the new and rewritten ground(s) of rejection set forth above, which have been necessitated by current amendments.

Conclusion

Applicants' amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

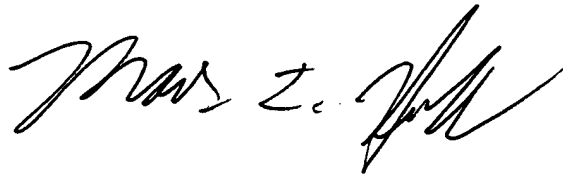
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1756

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



John Ruggles
Examiner
Art Unit 1756



MARK F. HUFF
SUPERVISORY PATENT EXAMINER
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